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RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-4 *Name:* Sport Fish Investigations of Alaska.

Study No.: G-I *Study Title:* Inventory and Cataloging.

Job No.: G-I-F *Job Title:* Inventory and Cataloging of the Sport Fish and Sport Fish Waters of the Copper River, Prince William Sound, and the Upper Susitna River Drainages.

Period Covered: July 1, 1971 to June 30, 1972.

ABSTRACT

Twenty-six lakes previously unsurveyed were sampled with gill nets for fish population analysis. Ten of these lakes are located in Prince William Sound.

Fourteen managed lakes were also sampled to determine the success and condition of experimentally stocked fish, and the status of existing native fish stocks. During the 1970-71 winter, there was a complete winterkill in 4 of the 14 managed lakes checked.

Tests conducted in Moose Lake since 1964 show a correlation between net frequencies for Arctic grayling, Thymallus arcticus, and dissolved oxygen concentrations.

With the cooperation of the Commercial Fisheries Division and the U. S. Forest Service, 220 streams in Prince William Sound were surveyed. These surveys were part of an overall resource inventory of the area.

A programmed creel census was conducted on salmon fishermen at Port Valdez. Fourteen hundred thirty anglers were interviewed. An estimated 3,300 anglers took 4,488 pink salmon, Oncorhynchus gorbuscha, and 2,098 silver salmon, O. kistuch.

Anglers caught an estimated 4,000 red salmon, O. nerka, and 700 king salmon, O. tshawytscha, from the Gulkana and Klutina rivers.

Dissolved oxygen determinations were made on 21 lakes during the winter.

King salmon surveys were conducted on 11 streams in the area to determine escapement. The 1971 estimated escapement of king salmon into the upper Copper River drainage was 13,244.

Caribou and Elbow lakes, adjacent to the Lake Louise road, were rehabilitated with liquid and powdered rotenone and will be restocked with salmonids.

Fifteen state, federal, and private construction projects involving the possibility of fish and fish habitat losses were investigated.

Ground surveys were made at Hanagita Lake during the in-migration of steelhead trout, Salmo gairdneri. Only 12 fish were seen in three days.

Age and maturity studies of burbot, Lota lota, from Susitna Lake, in the Susitna River drainage, indicate that they do not spawn every year.

RECOMMENDATIONS

1. Continue cataloging and inventory surveys with emphasis on the Prince William Sound area.

2. Continue the program of winter dissolved oxygen determinations to determine minimum requirements for overwintering of fish in various waters.

3. Continue the study of anadromous fish stocks in the area.

4. Life history studies of burbot should be continued with emphasis on Susitna, Louise, and Crosswind lakes.

5. Continue experimental stocking of salmonids and other hatchery produced fish where conditions are deemed suitable, and follow-up surveys conducted to determine the success of these experimental introductions.

6. Continue rehabilitation of suitable lakes and the establishment of sport fisheries where practical.

7. Continue the monitoring of pipeline preconstruction, road and bridge construction, and other land uses to afford maximum protection to the fishery resources and habitat.

OBJECTIVES

1. To determine the environmental characteristics of the existing and potential recreational fishing waters of the job area, and where practical, obtain estimates of the sport fish harvest and angler participation rates.

2. To assist in determining the current status of public access to the recreational fishing waters within the job area, and to make recommendations for selection of recreational fishing access sites.

3. To evaluate multiple water-use development projects (public and private) and the effects on the area's streams and lakes.

4. To determine stocking measures and formulate recommendations for the management of area waters, and direct the course of future studies.

5. To determine the magnitude of anadromous fish stocks and develop plans for their enhancement with emphasis on red salmon and king salmon.

TECHNIQUES USED

Standard techniques as described by Williams (1971) were used in lake and stream surveys, water sample analyses, and net and seine fish sampling.

The Cochran's Sampling Techniques (1963) were used for making estimates of total catch and effort during the Port Valdez creel census program. Using this technique, more sampling effort is expended during those hours of the day when fisherman landings are expected to be highest and on those days (weekends) when fisherman effort is the greatest. The data from these different periods was treated separately to prevent bias.

FINDINGS

Population Sampling - New Lakes

Twenty-six previously unsurveyed lakes were sampled with gill nets for fish species composition. The results of these surveys, including lake locations, are presented in Table 1.

Physical and biological data on 16 of these new lakes, located in the upper Susitna and Copper rivers drainages, is presented in Table 2. Data collected from lakes in Prince William Sound is shown in Table 3. Additional information is on file in the Glennallen and Anchorage Sport Fish offices.

Prince William Sound Lake Surveys

During 1971, with the cooperation of the Commercial Fisheries Division and the U. S. Forest Service, lakes in Prince William Sound were surveyed as part of an overall resource inventory. Thirteen lakes were test netted for population analysis, 10 of which were previously unsurveyed (Table 1).

During these survey trips, several lakes were investigated but not test netted because large numbers of mature salmon were attendant. Physical and biological data on these and the netted lakes are shown in Table 3.

TABLE 1 Test Gill-Net Summaries, New Lakes, 1971.

Name	Location	No. of Fish	Species*	Length (mm) Range	Length (mm) Mean	Frequency**	% Comp.
Cannery	T11N R11E S 28	2	CT	245 - 270	257	1.00	100
Chiemoviski (Lower)	T 5N R 7E S 13			No fish			
Chiemoviski (Upper)	T 5N R 7E S 1			No fish			
Cowpen	T11N R11E S 16	1	RS		560	1.00	33
		1	CT		340	1.00	33
		1	DV		215	1.00	33
Herring Bay (Upper)	T 4N R10E S 21			No fish			
Island	T10N R11E S 13			No fish			
Main Bay	T 5N R 8E S 19	2	DV	200 - 256	226	0.06	100
Pirate	T 9N R 6E S 21	4	DV	125 - 190	154	0.19	100
Solomon	T 9S R 6W S 21			No fish			
Turner	T11S R 8W S 15	10	DV	125 - 370	149	0.38	100
Louise (Chitina)	T 7S R13E S 35,36	48	SK			0.70	61
Coal	Lat. 62°56'N Long. 146°25'W	5	WF	255 - 292	276	0.15	100
Chetaslina	T 1N R 4E S 32			No fish			
Forty-Foot	T 4N R 7W S 16	2	GR	270 - 280	275	0.10	100
Kuskulana	Lat. 61°28'N Long. 144°07'W			No fish			

TABLE 1 (Cont.) Test Gill-Net Summaries, New Lakes, 1971.

Name	Location	No. of Fish	Species*	Length (mm) Range	Mean	Frequency**	% Comp.
Lupis	T 2S R 5E S 12			No fish			
Marty	Lat. 61°26'N						
	Long. 144°04'W			No fish			
Mile 36	Lat. 63°06'N	7	LT	245 - 620	349	0.20	35
	Long. 146°25'W	8	WF	190 - 395	274	0.23	40
		5	GR	130 - 290	196	0.14	25
Glacier	Lat. 63°07'N	26	LT	235 - 540	400	1.00	58
	Long. 146°15'W	10	WF	216 - 390	340	0.38	22
Mosquito	T 4N R 7E S 18	1	RT				
	T 9N R 4W S 32	18	LT	400 - 730	569	0.40	30
		41	WF	185 - 445	268	0.90	67
		2	SK	165 - 400	332	0.04	3
Paddle	Lat. 61°27'N						
	Long. 144°06'W			No fish			
Peanut	T 4N R 7W S 16			No fish			
Stick	T 4N R 7W S 17			No fish			
Teal	T 4N R 7W S 17	4	GR	280 - 320	300	0.20	100
Whale	Lat. 61°26'N						
	Long. 144°01'W	11	SK	103 - 303	162	0.25	100

*DV - Dolly Varden LT - Lake trout RS - Red salmon SK - Longnose sucker
GR - Grayling CT - Cutthroat trout RT - Rainbow trout WF - Whitefish
**Frequency is the number of fish per net hour.

TABLE 2 Physical and Biological Data from Lakes Surveyed in the Copper and Upper Susitna River Drainages, 1971.

Lake	Surface Area Acres	Maximum Depth (Ft.)	% of Shoal Area	Fish Species Present*	Sub-Drainage
Whale	1,200	26	25	SK	Kuskulana River
Paddle	1,150	85			Kuskulana River
Marty	70	55	5		Kuskulana River
Kuskulana	80	60	5		Kuskulana River
Mosquito	21	13	100	RT	Chitina River
Louise (Chitina River)	440	40	30	GR,SK	Chitina River
Chetaslina	100	15	100		Chetaslina River
Lupis	130	50	15		Kotsina River
Stick	9	13	100		Mendeltna Creek
Peanut	12	35	20	Sc	Mendeltna Creek
Forty-Foot	7	42	15	GR	Mendeltna Creek
Teal	15	18	75	GR	Mendeltna Creek
North	160	47	15	LT,WF,SK	Dog Creek
Mile 36 (Denali)	110	30	30	LT,GR,WF	Rock Creek
Coal	130	15	100	WF	Susitna River
Glacier	440	80	10	LT,WF,GR	Rock Creek

*SK - Suckers
RT - Rainbow trout
GR - Grayling
Sc - Sculpins
LT - Lake Trout
WF - Whitefish

TABLE 3 Physical and Biological Data of Lakes Surveyed, Prince William Sound, 1971.

Lake	Surface Area (Acres)	Maximum Depth (Ft.)	Elevation (Ft.)	% Shoal Area	Fish Species Present*	Fish Barrier in Outlet**
Bainbridge	125	57	75	20	RS,SS,PS,DV	No
Cannery	125	48	90	20	CT	Yes
Chiemoviski (Lower)	110	141	320	5	None	Yes
Chiemoviski (Upper)	100	122	330	7	None	Yes
Cowpen	120	55	150	5	RS,DV,CT	No
Eshamy	900	248	25	12	RS,SS,CT,DV	No
Gunboat (Lower)	45	50	30	30	RS,SS,CT,DV	Yes
Herring Bay	150	280	40	4	None	Yes
Island	40	55	20	5	None observed	No
Main Bay	870	285	160	5	DV	Yes
Solomon	120	15	625	100	None	Yes
Pirate	18	40	80	5	DV	Yes
Turner	80	60	130	10	DV	Yes

*RS - Red salmon; SS - Silver salmon; PS - Pink salmon; DV - Dolly Varden; CT - Cutthroat trout
**Fish migration from salt water upstream into the lake was not possible.

The lakes surveyed in Prince William Sound are generally deep, exceeding 100 feet in depth, and have little shoal area. Surface water temperatures seldom exceed 50°F (10.0°C) and the lakes are low in productivity due to the high water exchange rate. This area is recently glaciated, has steep slopes, little soil cover, and the heavy rainfall and deep snow pack results in excessive runoff.

The lakes in Prince William Sound can be separated into two general categories: those with no inlet or outlet barriers to anadromous fish, and those with barriers.

The lakes having anadromous fish populations are characteristically more productive, due to annual fertilization by salmon carcasses. In addition, salmon smolt are available to fill an important role in the food chain of cutthroat trout, Salmo clarki, and Dolly Varden, Salvelinus malma.

Productivity is low in those lakes without anadromous fish populations, which is usually a result of barriers in the outlet streams, and the water is generally very clear. Fish populations, if any, are composed of stunted Dolly Varden; cutthroat trout; sculpins, Cottus sp.; and stickleback, Gasterosteus aculeatus. Some lakes on the mainland near Cordova have been planted for years with rainbow trout, S. gairdneri. Growth, however, has proved to be slow and in the future, only those lakes with good access, in areas of expected high angler use, will be considered for stocking.

Sport fishing pressure in Prince William Sound is low, although one important lake system on which fishing pressure information is available, is Eshamy Lake. Most of the sport fishing is done in the outlet, where it enters salt water. In 1969, Commercial Fisheries Division personnel recorded 502 red salmon, Oncorhynchus nerka, and pink salmon, O. gorbuscha, taken by sport fishermen. In 1971, the recorded sport fish catch at this location was 362.

Population Sampling - Managed Lakes

In 1971, 14 managed lakes were test netted to determine the results and progress of experimental fish stocking and changes in status of natural stocks (Table 4).

During the winter of 1970-71, the concentration of dissolved oxygen in Moose Lake dropped to only a trace. Following spring breakup, test netting was conducted and three overnight sets caught only one longnose sucker, Catostomus catostomus. The winterkill appeared almost complete, as large numbers of dead burbot; grayling, Thymallus arcticus; and suckers were found in the shallow waters.

TABLE 4 Test Gill-Net Summaries, Managed Lakes, 1971.

Name	Location	No. of Fish	Species*	Length (mm) Range	Length (mm) Mean	Frequency**	% Comp.
Arizona	T 8N R 3W S 11			No fish			
Caribou (Lake Louise)	Lat. 62°12'N Long. 146°31'W			No fish			
Dick	T13N R 1W S 31	6	GR	120 - 330	169	0.14	66
		3	SS	115 - 118	116	0.07	33
Elbow	T 5N R 7W S 22	2	GR	280 - 300	290	0.05	100
Esther	T 9N R 8E S 29	1	DV		300	0.09	100
Red	T 9N R 9E S 17	2	DV		125	0.08	50
		2	SS		105	0.08	50
Eyak	Lat. 60°33'N Long. 145°40'W	60	SS		110	1.26	38
		51	RS			1.06	32
		44	DV	130 - 390	218	0.90	28
		3	CT	185 - 240	218	0.06	2
		2	WF	430 - 440	435	0.04	1
Kettle	T 9N R11 E S 18	3	SK	260 - 330	295	0.50	60
		1	LT		355	0.50	20
		1	BB		365	0.50	20

TABLE 4 (Cont.) Test Gill-Net Summaries, Managed Lakes, 1971.

Name	Location	No. of Fish	Species*	Length (mm) Range	Length (mm) Mean	Frequency**	% Comp.
Louise	T 8S R13E S 1	48	SK			0.70	61
		30	GR	125 - 330	250	0.56	39
Moose (McCarthy)	T 6S R10E S 3			No fish			
Moose	T 4N R 5W S 13	1	SK		123	0.01	100
Ewan	T 4N R 7E S 26			No fish			
Tolsona	T 4N R 5W S 24	75	GR	132 - 332	249	1.66	88
		9	SK	360 - 447	411	0.20	11
		1	BB			0.02	1
Ruth	T 6S R11E S 9			No fish			

*BB - Burbot
CT - Cutthroat trout
DV - Dolly Varden
GR - Grayling
LT - Lake trout
RS - Red salmon
SS - Silver salmon
SK - Longnose sucker
WF - Whitefish

**Frequency is the number of fish per net hour.

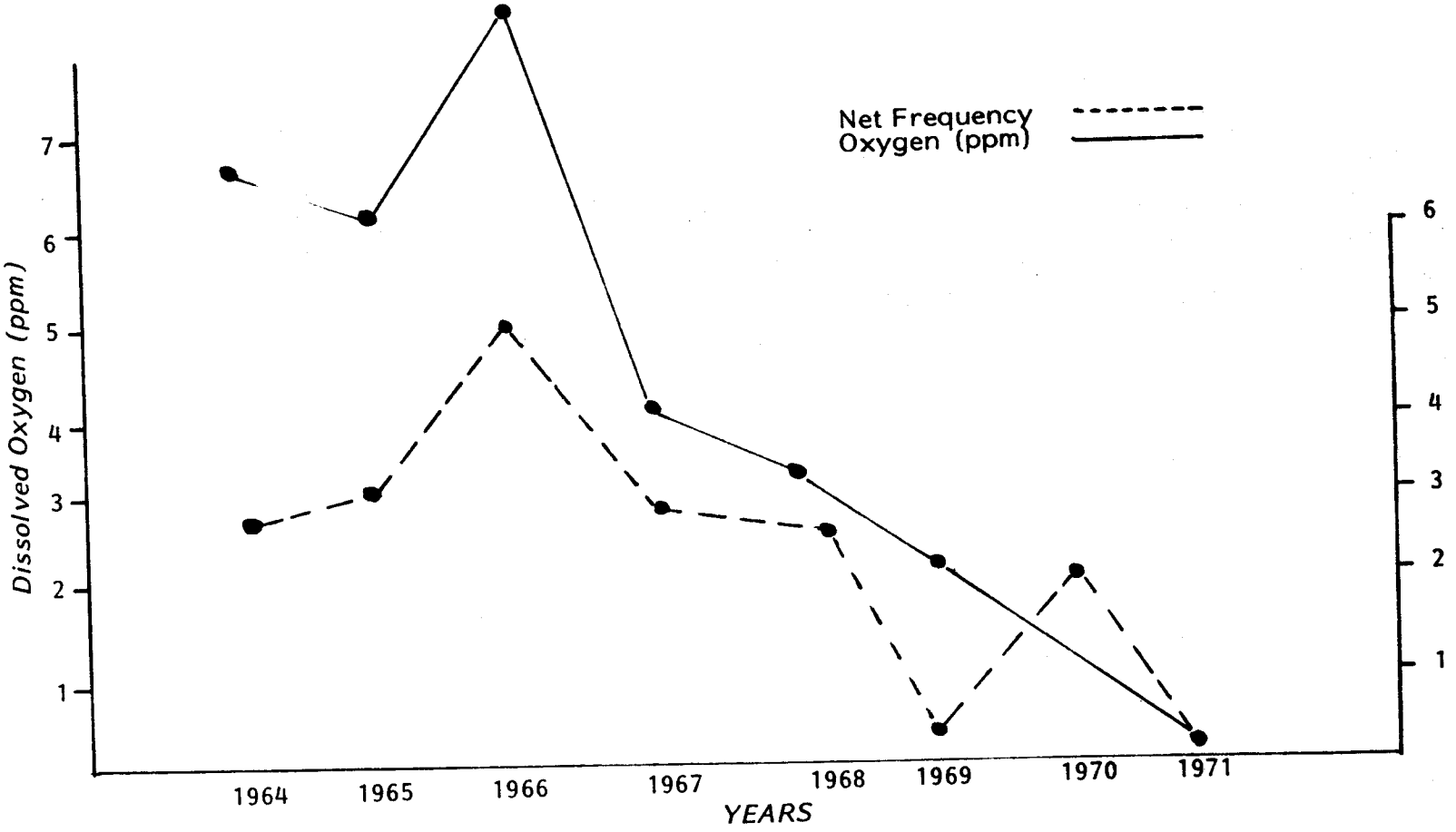

FIGURE 1 A COMPARISON OF DISSOLVED OXYGEN CONCENTRATIONS AND NET FREQUENCIES (FISH/NET HOUR) FOR GRAYLING, MOOSE LAKE, 1964-1971.

Figure 1 shows a correlation between dissolved oxygen concentrations and the frequency (fish per net hour) of grayling in Moose Lake. As the amounts of available dissolved oxygen dropped, the relative numbers of grayling captured decreased. In 1970 an increase in the frequency of net-captured grayling occurred which is attributed to artificial stocking conducted in 1969. There has been very little natural spawning in Moose Lake since 1967. Eighty percent of the grayling taken in gill nets in 1970 were age 1+.

The decline in the grayling net frequency in 1971, despite annual stocking, is thought to be the result of the severe drop in the winter dissolved oxygen concentrations.

During the summer, 1971, the creek between Moose and Tolsona lakes began flowing and a limited migration of grayling into Moose Lake probably occurred; however, Moose Lake will be restocked as soon as grayling eggs become available for hatching purposes.

Tolsona Lake also experienced a winterkill during 1970-71 when the dissolved oxygen concentration dropped to 0.5 ppm. Although the dissolved oxygen concentration was the lowest recorded in nine yeears, the net frequency for grayling was 1.66 higher than four prior years since 1963. Field observations of this winterkill indicate that approximately 85% of the dead fish were burbot and suckers, suggesting that grayling may have a higher tolerance to low oxygen concentrations than other species of fish.

In 1968 grayling were introduced into Arizona Lake. By 1970 these fish had reached an average fork length of 236 mm and were sexually mature. In 1971 no fish were taken during test netting. The concentration of dissolved oxygen dropped to a record low of 0.5 ppm, and at the time of breakup, several dead grayling were observed in shallow water. No live fish were seen during several visits to the lake.

Ruth and Moose lakes, located along the Chitina-McCarthy road, were experimentally stocked with grayling in 1969. Test netting in 1970 revealed good survival in both lakes; however, in 1971 no fish were taken. Tests conducted on concentrations of dissolved oxygen showed 3.0 ppm in Ruth Lake and 2.5 ppm in Moose Lake. These dissolved oxygen levels are considerably above the apparent minimums for overwinter survival of grayling. This suggests errors in computing amounts of dissolved oxygen and/or the presence of some unknown factor lethal to grayling.

Caribou and Elbow lakes, located on the Lake Louise road, were test netted in 1971. No fish were taken from Caribou Lake and only two grayling were caught at Elbow Lake. Rainbow trout and silver salmon, O. kistuch, have been planted in these lakes since 1965 with poor success. These lakes were rehabilitated in 1971 and will be restocked in 1972.

Dick Lake, along the Richardson Highway, was stocked with silver salmon in 1971. Test netting in 1971 produced four fish averaging 116 mm in fork length.

Kettle Lake, along the Nebesna road, was stocked with young-of-the-year lake trout, S. namaycush, in 1967. At that time, only suckers were known to be present in the lake. In 1971 a lake trout 355 mm in fork length, one burbot, and three suckers were taken.

Eyak Lake is being considered for rehabilitation in the near future and as a result, species composition studies were initiated in 1971. Three gill nets captured 3 cutthroat trout, 44 Dolly Varden, 2 whitefish (Coregonus sp.), 60 silver salmon, and 51 red salmon. All of the red salmon were mature spawners and test netting was discontinued to prevent damage to the gill nets by this species. Test netting in the future will be conducted immediately after ice breakup to avoid this problem.

Esther Lake, located on Esther Island in Prince William Sound, was test netted and sounded for depth again in 1971. Two nets took only one Dolly Varden and the new soundings showed a maximum depth of 316 feet, rather than the 150 feet previously reported. This 1,400-acre lake is separated from salt water by two waterfalls in the outlet, both over 60 feet high. Because of its remoteness, no stocking is planned for this lake.

Red Lake, formerly referred to as Charlie Lake, was test netted in 1971. One small Dolly Varden and a singler silver salmon smolt were taken in a 24-hour set. This lake is used by red and silver salmon for spawning.

Ewan Lake was first surveyed in 1965 during post-earthquake studies, and a second time in 1971 to complete the basic data survey. The maximum depth was 224 feet, rather than the 135 first reported. Three inlets were located, although only one offered any appreciable flow. The outlet is blocked to upstream fish movement by at least 65 feet of waterfalls. Test netting was unsuccessful. Sculpins were observed. There is adequate beach spawning areas for an estimated 10,000 salmon; however, the expense of constructing a fish passage is too great for present rehabilitation.

Prince William Sound Stream Surveys

During 1971, four 10-day trips and one 4-day trip were made jointly with the U. S. Forest Service to Prince William Sound for survey and inventory work.

The first trip in late May was not very productive due to the late spring and a heavy snow cover. During the remaining trips, a total of 220 numbered streams (from the Anadromous Fish Catalog) and a few unnumbered streams were investigated.

The physical characteristics of streams in Prince William Sound are typical of recently glaciated areas. Land contours are steep and rough. The streams are generally small (less than 25 feet wide) and most are less than four miles in length. The streams are composed of shallow gravel, rubble, or exposed bedrock. Stream flows fluctuate greatly because of heavy precipitation and summer water temperatures seldom exceed 50°F (10°C). The majority of the streams have a steep gradient with one or more falls, many of which create barriers to anadromous fish and limit their distribution to the intertidal zone. Many streams have no resident sport fish populations.

Pink salmon and chum salmon, O keta, utilize most of these streams successfully for spawning. The numbers of spawning salmon observed vary from only a few to 30,000. Pink and chum salmon do not depend heavily on a freshwater environment to complete their life cycle and are the most abundant salmon species found in Prince William Sound.

Few streams are large enough to provide rearing habitat for red and silver salmon. These species are produced mainly from lake systems at low elevation where the outlet streams have no barriers and subsequently function as a passage to and from salt water.

The location and number of streams investigated are as follows: Columbia Bay - 6; Long Bay - 11; Long Bay to Wells Bay - 18; Unakwik Inlet - 21; Eaglek Bay - 26; Esther Island and Esther Passage - 26; Esther Passage to Coghill Lake - 14; Passage Canal and the west shore of Port Wells - 29; Eshamy Bay to Port Bainbridge - 53; and Jack and Galena bays - 16.

Burbot

Table 5 presents age and length data from Susitna Lake sport-caught burbot. Otoliths were taken from a sample of 16 burbot collected on March 15 and 16, 1972, and 23 sets were legible for age determination. Fifteen of the fish aged were females and eight were males.

TABLE 5 Age and Length of Sport-Caught Burbot, Susitna Lake, 1972.

Age	Length (mm) Range	Avg.	No. of Fish
VII	430 - 510	466	4
VIII	515 - 540	527	2
IX	335 - 765	548	7
X	340 - 690	511	4
XI	560 - 720	641	3
XII	855	855	1
XIV	720 - 840	780	2

The burbot in Susitna Lake appear to grow slower than those from other la of the area. The mean length of age VII burbot from Susitna Lake was 466 m while the mean lengths of similar age fish from Tolsona and Ewan lakes were and 576 mm, respectively.

The data presented in Table 6 indicates that the age of maturity for fem burbot in Susitna Lake is indecisive. Although all of the burbot checked were VII or older, only one-third of the fish would have spawned in 1972. By contra it was found that all age V fish taken from Moose and Tolsona lakes were matur and ranged in total length from 502 - 580 mm. Information from burbot studies Wyoming (Miller, 1970) show that 43% of all age III burbot in Ocean Lake we mature and 96% of the age IV fish were mature. Age III burbot from Ocean La averaged 467 mm in total length and age IV burbot averaged 595 mm.

If maturation in burbot is a function of size, as is found in some other fishes, then this data suggests that burbot in Susitna Lake do not spawn every year. This phenomenon is also found in lake trout.

TABLE 6 Age and Maturity of Susitna Lake Female Burbot, 1971.

Ovary Condition*	No. of Fish	Length (mm) Range	Length (mm) Avg.	Age Range	Age Avg.
Well Developed Skeins	5	340 - 855	668	IX - XIV	XI
Underdeveloped Skeins	10	335 - 605	540	VII - X	IX

*Well Developed Skeins: These females would probably have spawed within a week of the collection date.
Underdeveloped Skeins: These females appeared to be mature (size), but the eggs were very small and these fish would not have spawned in 1972.

Klutina River Salmon Fishery

The Klutina River is one of the larger tributaries of the Copper River. This stream originates in the Chugach Mountains at Klutina Glacier, and flows into Klutina Lake. From the lake, the river runs a distance of about 25 miles to the Copper River near the community of Copper Center. At the bridge crossing in Copper Center, the river is approximately 150 feet wide and the current is very fast. The water has a milky, glacial color.

The Klutina River is accessible by automobile at Copper Center (Richardson Highway) and for about eight miles below Klutina Lake. A pioneer access road connects Klutina Lake with the Richardson Highway. Primary fishing areas are shown in Figure 2.

Prior to 1970 there was little fishing pressure on the Klutina River. A few anglers drove to Klutina Lake and sport fished for Dolly Varden and lake trout just below the outlet, but sport fishing effort near the Richardson Highway bridge did not exceed 75 man-days of effort annually.

During 1970 significant numbers of sport fishermen began fishing the Klutina River for salmon. Some of the anglers interviewed said they had come to this area because the Russian River was closed. The estimated sport catch from the Klutina River in 1970 was 800 red salmon and 100 king salmon, O. tshawytscha. In 1971 an estimated 1,500 - 2,000 red salmon were caught by sport fishermen, and, in addition, 150 - 200 king salmon were taken. The minimum 1971 red salmon escapement was 51,000 (observed).

In 1971 a car counter was installed on the Klutina Lake road at Mile 21.5 by the Bureau of Land Management. Six hundred seventy-one vehicles were recorded from June 28 through August 19. Not all of this travel was for the purpose of fishing, as this area is also popular for black bear hunters, campers, hikers, and outdoor enthusiasts in general.

On July 4, 1971, an aerial survey of the Klutina River was conducted. Over 100 vehicles were parked near the bridge at Copper Center. Seventy anglers were counted on the river between Copper Center and Klutina Lake, and 110 vehicles were counted on the Klutina Lake road.

Gulkana River Salmon Fishery

The Gulkana River is the most important tributary of the Copper River because of its high recreational value and large salmon escapement. This stream is the largest clear river in the Copper River drainage, and provides excellent fishing for grayling, rainbow trout, red salmon, king salmon, and steelhead trout.

The main branch of the Gulkana River originates at the Gulkana Glacier above Summit Lake, which is adjacent to the Richardson Highway. The stream flows through Summit and Paxson lakes and parallels the Richardson Highway for approximately 60 miles until joining the Copper River below the village of Gulkana. The Gulkana River is a well-known and popular stream for float trip enthusiasts. The most heavily utilized areas on the Gulkana River are shown in Figure 3.

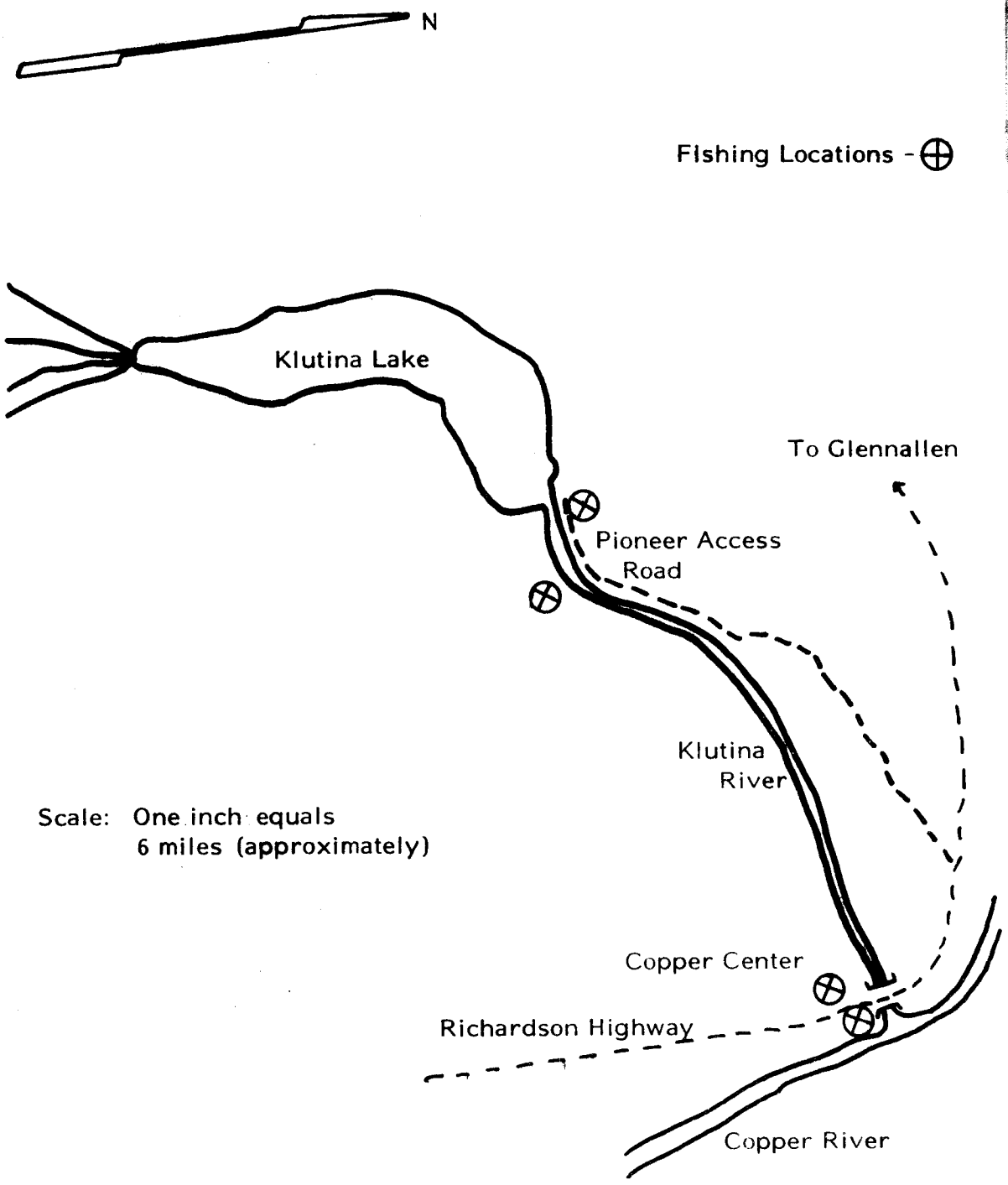

FIGURE 2 PRIMARY FISHING LOCATIONS, KLUTINA RIVER.

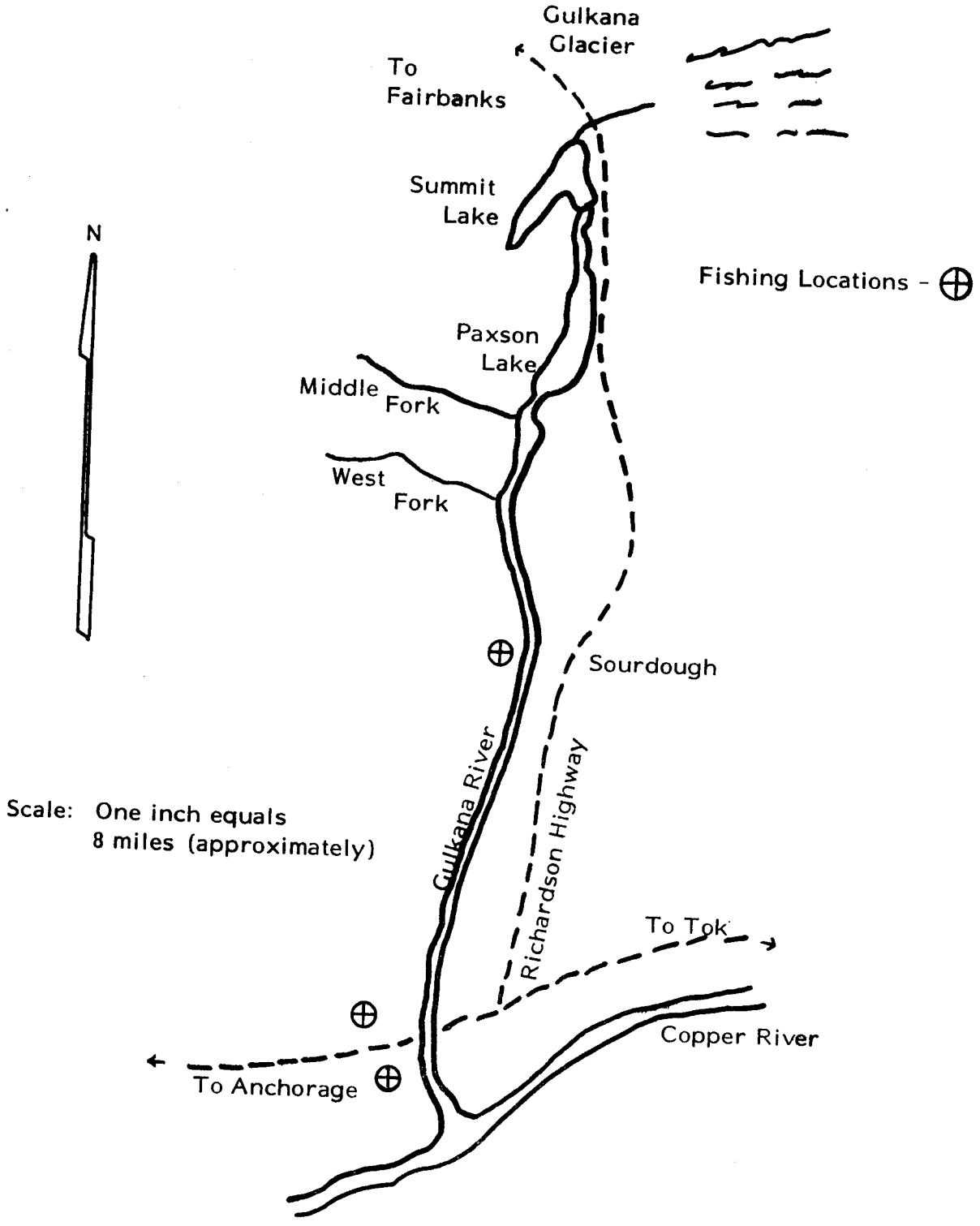

FIGURE 3 PRIMARY FISHING LOCATIONS ON THE GULKANA RIVER.

Prior to 1969 most of the salmon fishing was done from Sourdough Creek upstream and the king and red salmon catch was less than 700 fish annually. In 1969 anglers began fishing the portion of the Gulkana River adjacent to the Richardson Highway bridge near Glennallen. During June of that year, anglers took 500 king salmon from this area.

In 1970 the catch was approximately the same. Emergency closures were employed both in 1969 and 1970 due to extreme low water conditions which made it difficult for the salmon to reach upstream spawning areas. In 1971 the catch was about the same although angling pressure was double that of previous years. Normal, high water conditions reduced the catch rate and allowed adequate numbers of king salmon to reach the spawning area.

During 1971 the sport catch of red salmon from the Gulkana River was 1,500 - 2,000 fish. During an aerial survey of the Gulkana River on July 4, 1971, over 100 anglers were fishing the stream in the vicinity of the Richardson Highway bridge and 115 campers and other vehicles were parked in the immediate area.

There are several reasons for the rapid increase in fishing pressure on the Gulkana River: (1) restrictions on salmon fisheries in other portions of the state, (2) the Gulkana River is accessible at several points by vehicle and short foot trails, (3) the stream flow is not extremely fast and the shoreline is easy to negotiate, and (4) the stream supports good populations of fish other than salmon.

Port Valdez Creel Census

A creel census program was conducted during the summer, 1971 to determine the harvest of sport-caught salmon from Valdez Bay. A statistician from the National Marine Fisheries Service assisted in organizing this creel census program. The census period was from June 16 through September 6, 1971. During this period census was conducted on 32 days. More sampling effort was expended on those days (weekends) when fishing pressure was greatest and during those hours when landings were heaviest. Twenty-one of the 32 census days were weekends. Censusing was conducted during the period from 3:00 PM to 8:00 PM on 31 of the census days. All census days were divided into five periods starting at 9:00 AM and ending at 10:00 PM. Data collected from the various days and hourly periods were treated separately to avoid bias.

During the creel census 1,430 anglers were contacted and 1,950 pink salmon, 902 silver salmon, and 99 chum salmon were checked. As can be seen in Table 7 pink salmon comprised 100% of the salmon catch up to July 24 (third period). During the fourth period (August 7 through August 20), the catch of pink salmon and silver salmon was almost identical. The estimated man-days of fishing effort during the creel census program was 3,300. The anglers averaged 0.63 salmon per hour and 2.06 salmon per fisherman.

All fishing trips were by boat. Each boat trip averaged 2.97 fishermen, who expended 3.27 angler-hours each.

Thirty-two percent of the anglers interviewed were Valdez residents. Fifty-eight percent were from other parts of Alaska, and 10% were nonresidents.

TABLE 7 Summary by Sampling Period of Estimated Pink and Silver Salmon Catch and Hours of Fishing Effort, Port Valdez, 1971.

Period	Dates	Est. Catch		Est. Fishing Hours
		Pink Salmon	Silver Salmon	
1	6/26 - 7/ 9	1,296	0	1,660
2	7/10 - 7/23	1,019	0	480
3	7/24 - 8/ 6	771	225	1,287
4	8/ 7 - 8/20	1,264	1,168	4,860
5	8/21 - 9/ 3	136	648	1,332
6	9/ 4 - 9/ 6	1	57	836
Total		4,488	2,098	10,455

An annual silver salmon derby in Valdez Bay is held during the month of August. During this time, anglers averaged 0.28 silver salmon per hour, 0.50 pink salmon per hour, for an aggregate of 1.78 salmon per hour.

Fork length measurements were taken from 88 pink salmon. These fish ranged in length from 374 - 630 mm, with a mean length of 495 mm. Fork lengths from 69 measured silver salmon ranged from 523 - 824 mm with a mean length of 674 mm. Weights of silver salmon ranged from 5.5 - 14.25 pounds (2.5 - 6.5 kg), and averaged 9.5 pounds (4.3 kg).

Scales from 58 silver salmon were read for aging purposes. Sixty-eight percent of these fish were four years old (2.1) and the remainder were three year fish (1.1).

Notable during this creel census was the 113 halibut, Hippoglossus sp., caught by anglers. Thirty-four of these fish were measured and ranged from fork length from 340 - 1,580 mm and averaged 782 mm.

Also recorded in the sport catch during the creel census program were king salmon; Dolly Varden; rockfish, Sebastodes sp.; Irish lord, Hemilepidotus sp., butter clams, Saxidomus sp., and dungeness crab, Cancer magister.

A small cod, Gadus sp., fishery also exists off the Valdez City dock which attracts many nonresidents. At noon on July 4, 39 people were fishing from this dock.

King Salmon Escapement Surveys

Since 1968 there has been a steadily increasing interest in king salmon by sport fishermen. The estimated king salmon catch from the Copper River drainage in 1971 was 1,000. The majority of the catch came from the Gulkana River and the Klutina River.

During 1971 the Commercial Fisheries Division conducted tag and recovery studies in Woods Canyon (Copper River) on red and king salmon. The estimated king salmon escapement to the Upper Copper River was 13,224.

Table 8 lists the streams where aerial surveys for king salmon were conducted in 1971. There are other streams where small numbers of king salmon are known to spawn but these streams were not surveyed because of their small size and the lack of time.

TABLE 8 King Salmon Aerial Surveys, Copper River Drainage, 1971.

Stream	Maximum Count*	
Gulkana River	584	
Middle Fork Gulkana River	175	
Indian River	200	
Little Tonsina River	200	by helicopter
East Fork Chistochina River	512	
Tonsina Lake outlet	4**	
Grayling Creek	45	
St. Anne Creek	4	
Manker Creek	30	
Kiana Creek	81	
Mendeltna Creek	56	

*Counts made by Sport Fish and Commercial Fisheries division personnel using a 150 Piper Supercub airplane.
**Stream very silty.

Steelhead Trout Studies

On September 4 and 6, 1971, ground observations were conducted at Hanagita Lake and Hanagita River. At this time only 12 steelhead trout were observed. Five fish were caught, measured, and scale samples removed. The three females sampled ranged in length from 545 - 580 mm and averaged 632 mm. The two males were 721 and 757 mm in fork length.

The females were IV, V, and VI years old. The age VI had spawned in its fifth year. The two males were age IV and VI and neither had spawned previously.

These steelhead trout migrate into Hanagita Lake in the fall and remain in the lake all winter. In the spring they spawn and return to the ocean. A local guide who has a camp on Hanagita Lake reports that the steelhead trout come up the river over a period of approximately a month. A field trip was made to the lake on April 29, 1971. Most of the creek was open but no fish were observed.

Winter Dissolved Oxygen Determinations

Dissolved oxygen tests were conducted on 21 lakes during 1971 (Table 9) in a continuing study to determine minimum winter dissolved oxygen levels for various species of fish.

TABLE 9 Winter Dissolved Oxygen Determinations, Glennallen Area, 1971.

Date	Lake	Snow (In.)	Ice (In.)	Sample Depth (Ft.)	Oxygen (ppm)
3/19	Muskrat	12	29	5	Trace
3/19	Nita	10	32	5	6.0
4/ 1	Moose (Chitina)	12	42	5	2.5
4/ 1	Ruth	12	47	5	3.0
4/ 1	Tolsona	6	36	5	Trace
4/ 2	Gergie	12	29	5	1.5
4/13	2-Mile (Chitina)	0	47	5	5.5
4/14	Buffalo	12	36	5	3.5
4/15	Caribou	12	30	5	5.0
4/15	Crater	4	36	5	6.0
4/15	Elbow	4	39	5	5.0
4/15	Junction	2	51	5	5.5

TABLE 9 (Cont.) Winter Dissolved Oxygen Determinations, Glennallen Area, 1971.

Date	Lake	Snow (In.)	Ice (In.)	Sample Depth (Ft.)	Oxygen (ppm)
4/16	Dick	16	30	5	11.0
4/19	Arizona	8	31	5	0.5
4/19	Harvey	8	34	5	1.0
4/19	Kay	4	34	5	Trace
4/20	Burnt	4	47	5	6.5
4/20	Mirror	14	25	5	5.5
4/20	Popeye	2	45	5	1.0
4/22	Moose	4	33	5	Trace
4/23	Bear Cub	6	45	5	3.5

Table 10 shows comparative data relating to dissolved oxygen concentrations for various lakes in the study area. Fourteen lakes are represnted in this table. Nine showed a decrease in dissolved oxygen from 1970 to 1971, four showed no change, and one exhibited an increase.

Mitigation of Fish and Fish Habitat Losses

During 1971, 15 projects involving the possible loss of fish and fish habitat were investigated. These included highway construction projects, beaching areas, tank farm construction, bridge and culvert installation, and the proposed Trans-Alaska Pipeline.

These investigations involved field surveys and meetings with various agencies, including the Alaska Department of Highways, U. S. Army Corps of Engineers, the Bureau of Land Management, and the Alyeska Pipeline Company. Contributions were made to environmental impact statements regarding three proposed highway construction projects.

An inspection of the first 44 miles of the proposed Chitina-McCarthy road was conducted in cooperation with the U. S. Bureau of Land Management and the Alaska Department of Highways. Recommendations were made for strategic pull-outs and parking areas for anglers, and for proper placement of culverts and bridges.

TABLE 10 Comparison of Dissolved Oxygen Concentrations, Ice Thickness, and Snow Depths, Glennallen Area, 1970-1971.

Lake	1970 Date	1970 Snow (In.)	1970 Ice (In.)	1970 Oxygen (ppm)*	1971 Date	1971 Snow (In.)	1971 Ice (In.)	1971 Oxygen (ppm)*
Arizona	4/ 8	10	25	4.0	4/19	8	31	0.5**
Caribou	4/ 1	10	21	6.5	4/15	12	30	5.0
Crater	4/ 1	8	24	6.0	4/15	4	36	6.0
Dick	3/ 9	14	29	9.5	4/15	16	30	11.0
Elbow	4/ 1	8	30	6.5	4/15	4	39	5.0
Junction	4/ 1	8	31	5.5	4/15	2	51	5.5
Kay	4/ 9	4	30	0.0	4/19	4	30	0.0
Mirror	4/ 8	10	25	6.5	4/20	14	25	5.5
Moose (Chitina)	3/15	0	29	7.0	4/ 1	12	42	2.5**
Moose	3/21	0	30	1.5	4/22	4	33	0.0**
Muskrat	3/17	0	30	4.0	3/19	12	29	0.0
Nita	3/ 9	10	32	6.0	3/19	10	32	6.0
Ruth	3/26	0	29	1.0	4/ 1	12	47	3.0**
Tolsona	3/21	0	36	1.8	4/ 1	6	36	0.0**

*All oxygens taken at 5-foot depth, except Caribou, Crater, and Elbow lakes in 1971.
**Winter kill.

Lake Rehabilitation

During 1971 two small lakes along the Lake Louise Road were rehabilitated with powdered and liquid rotenone.

Caribou Lake has a surface area of 13 acres and a maximum depth of 25 feet. Fish species present prior to treatment with rotenone included rainbow trout, silver salmon, grayling, burbot, whitefish, and suckers.

Elbow Lake has a surface area of 4.5 acres and is 17 feet deep. Rainbow trout, silver salmon, grayling, whitefish, and suckers were present in the lake at the time of treatment.

The rotenone was applied in both lakes at a concentration of 1.75 ppm. The lake will be checked with test fish in 1972 and then restocked as soon as detoxification is established.

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